and Betchworth; and between that date and the middle of July the country from Aylesbury to Cuckfield will be systematically examined by the class so as to draw a section over the trough of the Thames basin, and see the deposits to the north and south of London, which underlie the rocks associated with the chalk. The class has been organised and carried on by Prof. H. G. Seeley, F.R.S., for the past twelve years, without difficulty of any kind, and without assistance. It was established as a class to show that systematic instruction in geology could be given in the open country, and the example it affords must tend to bring about more practical teaching in the matter of field-work. When the class began there was very little of such teaching anywhere, but the value of individual observation is now accepted as a canon of scientific education, and the success of Prof. Seeley's work should encourage educationists in their endeavour to get the fact-knowledge entirely substituted for the word-knowledge of books.

SOCIETIES AND ACADEMIES

DUBLIN.

Royal Dublin Society, March 16.—Prof. G. F. Fitzgerald, F.R.S., in the chair.—Prof. J. Joly, F.R.S., and Dr. H. H. Dixon read a paper on the distribution of coccoliths and on some microscopic organisms found in Dublin and Killiney Bays. Coccoliths have been found by the authors on the Irish coast at Sligo, Slyne Head, Dingle, Waterville, and along the coast of south Co. Dublin, and on the south coast of England at Weymouth. Samples of water from Loch Inver and Portstuart did not afford any examples. Coccoliths were also found in the mud obtained in the Severn and Liffey beds. In the paper are also described a new marine Difflugia and organisms from Killiney Bay resembling Ehrenberg's Pyxidicula and Xanthidia from the chalk.—A paper by Prof. W. Noel Hartley, F.R.S., and Mr. Hugh Ramage was then read by the former, the subject being a determination of the wave-lengths of the principal lines in the spectrum of gallium, showing their identity with two lines in the solar spectrum. The authors have found gallium to be a very widely distributed element in the earth, and to be present also in meteoric bodies. It became natural to inquire if it is present in the sun. The wave-lengths of the two principal lines have not previously been determined by a grating spectrograph, and the authors availed themselves of the kind offer of Dr. Adeney to allow them to photograph spectra of gallium with the 21½ feet radius grating spectrograph in the Physical Laboratory of the Royal University of Ireland. The two principal lines were photographed as bright and reversed lines in arc spectra, and as bright lines in the spark spectrum of a solution of gallium chloride. In these and in the oxyhydrogen spectrum of gallium compounds the less refrangible line is always stronger than the other. The wave-lengths of the two lines, determined by interpolation from adjacent iron lines, are found to be 4172·215 and 4033·125. In Rowland's map of the solar spectrum there are two lines probably identical with these, namely:—

4172·211. Source: Aluminium. Intensity: 1,
and 4033·112. Not identified. ,, 00.

It is pointed out that gallium is present in every bauxite and shale examined by the authors, and also in metallic aluminium, and no doubt the line 4172·211 in the spectrum of aluminium is really a gallium line. From the very close agreement of the wave-lengths, from the relative intensities of the lines as shown above, and from the evidence of the wide distribution of the element, it seems certain that the two gallium lines are identical with the two lines above mentioned in the solar spectrum, and there are no other lines so close to these. The evidence is discussed at length in the paper, as also is the effect of the presence of elements upon the spectra of other elements.—Prof. J. P. O'Reilly read a paper on the occurrence of anatase and brookite in the quartzites of Shankill, Co. Dublin. He explained that the minerals were found in a mass of yellow earth, met with by the quarrymen in 1888, and had only lately been examined. The peculiarity of the anatase was its approximation in composition to the clay or mineral analysed by Eakins as mentioned by Dana in his "System of Mineralogy," edition of 1892, p. 716, while presenting the crystalline form of anatase, thus allowing of the presumption that the clay analysed by Eakins and called by him "Xanthitane," was probably the product of decomposition of an anatase having much the same composition as the mineral found at Shankill.

EDINBURGH.

Royal Society, March 21.—Lord Kelvin, President, in the chair.—Lord Kelvin, in a paper on thermodynamics, deduced from motivity, fulfilled a promise made twenty-one years ago to the Society. After referring to the somewhat misleading phrase, *the mechanical equivalent of heat*, and pointing out the necessity of having a single word to express the availability of heat for transformation into useful work, he proceeded to show that the whole of thermodynamics was contained in the two equations

$$de = \mathrm{JN}dt + \Sigma(\mathrm{P}dg + \mathrm{JM}dg)$$

$$dm = \mathrm{J}\frac{t-\mathrm{T}}{t}\mathrm{N}dt + \Sigma\left(\mathrm{P} + \mathrm{J}\frac{t-\mathrm{T}}{t}\mathrm{M}dg\right)$$

where e is the energy, m the motivity, t the temperature of any part of the system, T the lowest temperature in the system, g any coordinate, P the corresponding force, and N, M specific heats. The usual equations are at once deduced by treating de, dm as complete differentials.—Dr. Galt, of Glasgow University, communicated a paper on the microscopical appearances of the grains in the more commonly occurring starches. The paper was full of detail, and was illustrated by numerous original photographs and lantern slides. In a paper on methods of mapping rainfall, Mr. A. J. Herbertson described a simple graphical method for taking into account the varying lengths of periods of observation of rainfall at different parts of the globe. The mean rainfall values were inserted on the maps in different coloured inks, according to the length of period of observation. The general trend of the isohyets could be attained by comparing similarly coloured means, and the final positions of the lines fixed by the values at the stations with the most extended records. The variableness in the length of the month is allowed for by drawing isohyetal lines, whose actual values are the nominal values multiplied by the days in the corresponding month, and divided by one-twelfth of a year expressed in days. In a second paper, on the normal rainfall of India and the abnormalities in 1896, Mr. Herbertson showed maps on the mean annual and monthly rainfall of India, based on the means published in the rainfall data for 1895, and those in the annual summary for 1896.

Royal Physical Society, March 16.—Mr. B. N. Peach, President, in the chair.—Papers were read by Mr. W. S. Bruce, of the Jackson-Harmsworth expedition, and Mr. William Eagle Clark, on the mammals and birds of Franz Josef Land. Mr. Bruce, who spent fifteen months on Franz Josef Land in 1896-97, explained that the number of species, exclusive of mammals and birds, he then obtained exceeded that of any previous Arctic expedition, he having secured 236 against 216 to the credit of the United States expedition of 1881-83. He had at least doubled the number of species known to Franz Josef Land. He had found ancient reindeer horns, though there were no reindeer at present in the Land. Among the specimens he exhibited were the bones of whales and walruses found on raised beaches with an elevation of from 50 to 80 feet, plainly indicating their great age; while one specimen—the scapula of a walrus—was found at a height of 336 feet. The chief point of interest in Mr. Clark's part of the subject, which was restricted to birds, was the finding of several new species—Bonaparte's sandpiper, purple sandpiper, and the shore lark. The first mentioned of these, Mr. Clark said, was not only a new and remarkable addition to the ornis of Franz Josef Land, but it was the first authentic example of this American species that had been obtained in Europe elsewhere than in the British Isles. Another subject of interest in the paper was the description of a newly-found nesting-place of the ivory gull. This was at Cape Mary Harmsworth, on what was considered to be one of the largest pieces of bare ground in Franz Josef Land. Of the twenty-two species of birds which formed the avifauna of Franz Josef Land, only ten had been found breeding, though several more undoubtedly nested there, while several, again, were mere stragglers.

PARIS.

Academy of Sciences, April 4.—M. Wolf in the chair.—On a doctrinal point in the theory of quadratic forms, by M. de Jonquières.—Contribution to the study of Zeeman's phenomenon, by MM. Henri Becquerel and H. Deslandres. An account of some experiments on the influence of a magnetic field upon the periods of vibration of the radiations emitted by incandescent vapours.—Movements of the sensitive plant when grown in water, by M. Gaston Bonnier. The author has succeeded in cultivating *Mimosa pudica* completely immersed in

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water, and has studied in detail the alterations in structure and movement brought about by the new conditions of life.—On the deformation of compressed parts and the stability of large frame-works, by M. A. Bérard.—On congruences which are in several ways K congruences, by M. C. Guichard.—New expression of the elements of an orthogonal system by *theta* functions of two arguments and their application in dynamics, by M. E. Jahnke.—On a transformation of Hamilton's equation, by MM. W. Ebert and J. Perchot.—On the deformations experienced by a solid dielectric on becoming the seat of an electric field, by M. Paul Sacerdote. The phenomena in question are shown to be deducible from the principles of the conservation of energy and of electricity.—On a problem in the analytical theory of heat, by M. W. Stekloff.—On the electric conductivity of solutions of permanganate of potassium, by M. Emmanuel Legrand. The molecular conductivity increases with the dilution, and approaches the limiting value 124 obtained by former experimenters for neutral salts at 25° C.—On multiple resonance, by M. Louis Décombe.—On the thermic mercurial ampère-meter and its industrial applications: new standard of electromotive force, by M. Charles Camichel.—Comparison of the atomic weights of hydrogen, nitrogen, and carbon deduced from physical data with their values as deduced from chemical analysis, by M. Daniel Berthelot. The author claims that the calculation of atomic volumes and atomic weights from accurate determinations of the density and compressibility allows of the confirmation and, in certain cases, of the statement with precision of the results given by chemical analysis. The results obtained by various observers in the case of the three elements mentioned are criticised in detail.—Isoquinoline and tetrahydroisoquinoline, by M. Marcel Delépine. A thermo-chemical study.—On the estimation of small quantities of carbon monoxide in air and in normal blood, by M. L. de Saint-Martin. The author, in reply to the criticisms of M. Gautier, further explains the analytical modifications introduced by him. A series of experiments are described to demonstrate the presence of carbon monoxide in the blood of animals living in large towns.—On the spectrum and the nature of neodymium, by M. Eug. Demarçay.—Action of oxidising agents on some nitrogenous bodies, by M. Œchsner de Coninck. An account of the action of hypochlorites, in presence of excess of alkali, upon amines, diamines, hydrazines, cyanic and cyanuric acids, and various alkaloids.—Combination of mercuric nitrate and trimethyl carbinol, by M. G. Denigès. The author describes the preparation and properties of a new compound, which he terms mercuroso-mercuric dimethylethylenic nitrate.—On the physiology of gentianose; its hydrolysis by soluble ferments.—Detection of wood saw-dust in flour, by M. G. A. Le Roy. The suspected sample is gently warmed with an alcoholic solution of phloroglucinol, strongly acidified with phosphoric acid. The particles of saw-dust are stained an intense carmine-red colour, while the starch and cellulose of the grain itself are little, or but slightly, affected.—On the crystalline forms of the *oligist* of Puy de la Tache (Mount Dore), by M. F. Gonnard.—On the micro-organisms of "turned" wines, by MM. F. Bordas, Joulin, and de Raczkowski. The authors have isolated and studied an organism, which they propose to term *Bacillus roseus vini* from the colour assumed by its cultivations in certain media.—Effects of the solar and lunar attractions upon the atmosphere of the northern hemisphere at each of the four phases, by M. A. Poincaré.

DIARY OF SOCIETIES.

FRIDAY, April 15.

Malacological Society, at 8.—On some New Species of Land Shells from South America: S. I. Da Costa.—Note on the Anatomy of *Resania*, Gray, and *Zenatia*, Gray: W. H. Dall.—Note on the Anatomy of *Mülleria*: M. F. Woodward.

MONDAY, April 18.

Society of Arts, at 8.—Sources of Commercial India-rubber: Dr. D. Morris, C.M.G.

Victoria Institute, at 4.30.—The Design of the Human Foot: Gerard Smith.

TUESDAY, April 19.

Zoological Society, at 8.30.—On the Breeding of the Dragonet (*Callionymus lyra*): Ernest W. L. Holt.—On the Serricorn Coleoptera of St. Vincent, Grenada, and the Grenadines, with Descriptions of New Species: Rev. H. S. Gorham.—Note on the Affinities of *Palæospondylus gunni*, Traq.: Dr. Bashford Dean.

Institution of Civil Engineers, at 8.—Paper to be discussed: The Electricity Supply of London: A. H. Preece.

Royal Victoria Hall, at 8.30.—X-Rays: Bruce H. Wade.

WEDNESDAY, April 20.

Society of Arts, at 8.—Stage Mechanism: Edwin O. Sachs.

Geological Society, at 8.—Note on an Ebbing and Flowing Well at Newton Nottage, in Glamorganshire: H. G. Madan.—*Petalocrinus*: F. A. Bather.—On the Origin of the Auriferous Conglomerates of the Gold Coast Colony (West Africa): T. B. F. Sam.

Royal Meteorological Society, at 7.30.—Anticyclonic Systems and their Movements: Major H. E. Rawson.—Results of Observations on Haze and Transparency in 1897: Hon. F. A. Rollo Russell.

Royal Microscopical Society, at 7.30.—An Exhibition of Diatoms: H. Morland.——At 8.—On some Organic Substances of High Refractivity available for Mounting Specimens for Examination under the Microscope: H. G. Madan.—Instantaneous Photomicrography: E. B. Stringer.

THURSDAY, April 21.

Society of Arts (Indian Section), at 8.—Recent Railway Policy in India: Horace Bell.

Linnean Society, at 8.

Institution of Electrical Engineers, at 8.—Cost of Generation and Distribution of Electrical Energy: R. Hammond. (Continuation of Discussion.)

Chemical Society, at 8.—The Carbohydrates of Barley Straw: C. F. Cross, E. J. Bevan, and Claud Smith.—Isomeric Bornylamines: Dr. M. O. Forster.—Some Derivatives of Benzophenone: Dr. F. E. Matthews.—Researches on Camphoric Acid: Dr. S. B. Schryver.—Ballot for Election of Fellows.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Books.—The Barometrical Determination of Heights: F. J. B. Cordeiro (Spon).—A Manual of General Pathology for Students and Practitioners: Dr. W. S. Lazarus-Barlow (Churchill).—Practical Radiography: A. W. Isenthal and H. S. Ward, 2nd edition (Dawbarn).—Elementary Chemistry: T. A. Cheetham (Blackie).—Synopsis Characearum Europaearum: Dr. W. Migula (Leipzig, Kummer).—Accounts of the Trade carried by Rail and River in India in the Official Year 1896–97 and the Four preceding Years (Calcutta).—Notes on Observations: S. Lupton (Macmillan).—An Elementary Course of Physics: edited by Rev. J. C. P. Aldous (Macmillan).—Essays on Museums, &c.: Sir W. H. Flower (Macmillan).

Pamphlets.—Some New Indo-Malayan Orchids: G. King and R. Pantling (Calcutta).—A Simple Guide to the Choice of a Photographic Lens: T. R. Dallmeyer (J. H. Dallmeyer).

Serials.—Knowledge, April (High Holborn).—Bulletin of the American Mathematical Society, March (N.Y., Macmillan).—Transactions of the Astronomical and Physical Society of Toronto, 1897 (Toronto).—Observatory, April (Taylor).—Atlantic Monthly, April (Gay).—Journal of the Sanitary Institute, April (Stanford).—Zeitschrift für Wissenschaftliche Zoologie, lxiii. Band, 3 Heft (Leipzig, Engelmann).—Materials for a Flora of the Malayan Peninsula: Sir G. King, No. 10 (Calcutta).—History of Mankind: F. Ratzel, translated, Part 25 (Macmillan).—Psychological Review, Monograph Supplements, Vol. 2, No. 2 (Macmillan).—Reliquary and Illustrated Archæologist, April (Bemrose).—Mind, April (Williams).

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